Before the
Federal Communications Commission
Washington, DC 20554

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| In the Matter of | ) | |
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| Amendment of the Commission's Rules to | ) | WT Docket No. 04-435 |
| Facilitate the Use of Cellular Telephones and | ) | |
| Other Wireless Devices Aboard Airborne Aircraft | ) | |

To: The Commission

**JOINT COMMENTS**
**OF CINGULAR WIRELESS**
**AND VERIZON WIRELESS**


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Cingular Wireless LLC ("Cingular") and Cellco Partnership d/b/a Verizon Wireless ("Verizon") hereby submit their joint comments in response to the Commission's *Airborne NPRM*.[1] These comments address the provision of service to aircraft passengers' CMRS devices while in flight by means of a picocell located in the aircraft and do not address the separate issue of using CMRS spectrum as a communications pipeline between the aircraft and ground networks.

## INTRODUCTION AND SUMMARY

Cingular and Verizon support the flexible use of spectrum for the delivery of commercial mobile radio services ("CMRS"). In establishing its CMRS rules, the Commission has long held that such flexibility is necessary to support a competitive market structure by promoting greater innovation and the more rapid introduction of new and advanced services to the public. The CMRS market and the customers it serves have greatly benefited from this flexible use approach.

[1] *Facilitating the Use of Cellular Telephones and other Wireless Devices Aboard Airborne Aircraft*, WT Docket 04-435, *Notice of Proposed Rulemaking*, FCC 04-288 (Feb. 15, 2005) (*Airborne NPRM*), *summarized*, 70 Fed. Reg. 11916 (Mar. 10, 2005); *Order*, DA 05-1015 (WTB Apr. 6, 2005).

The provision of wireless services onboard aircraft in flight is a natural extension of the services already provided by today's CMRS licensees. In fact, if not for the concerns about interference to terrestrial-based CMRS networks (and to aircraft navigation systems)[2], it is likely that these in-flight picocell services would already be provided by licensed wireless carriers within their CMRS service areas across the country, thanks to the flexibility afforded to them by the Commission.

There remains considerable concern, however, regarding the use of wireless devices onboard aircraft and the potential interference it would cause to terrestrial-based CMRS systems. Recent test data compiled in the *AirCell* proceeding, for example, clearly demonstrates that the airborne use of cellular handsets (and other CMRS devices) to communicate directly with terrestrial communications networks would result in a significant interference risk. The *NPRM* acknowledges the potential harms of such use, and tentatively concludes that airborne cellular use only be permitted if such devices are operated under the control of a "picocell" installed on the airplane.[3]

We agree that the use of airborne picocells may ultimately be an effective technological solution to interference. However, it is unclear at this point whether this can be accomplished. Even operating in a low power mode, CMRS devices used on board aircraft have the potential to interfere with CMRS base stations on the ground, and the operation of an airborne picocell has the potential to interfere with CMRS devices used on the ground. Moreover, base station

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[2] The Federal Aviation Administration ("FAA"), with assistance from the RTCA, is currently assessing the potential for interference to aircraft navigation systems. Cingular and Verizon acknowledge the importance of this initiative, but note that the instant proceeding is appropriately focused on the potential for interference to telecommunications networks.

[3] An airborne "picocell" is a low power base station installed in the aircraft that would communicate with and control the operations of wireless handsets and other devices.

operations on the ground have the potential to interfere with wireless devices used on the aircraft. CMRS licensees are the parties best positioned to resolve the difficult technical issues involved in deploying picocell-based airborne service in a manner that does not have adverse effects on terrestrial service. They have incentives to extend their service skyward while at the same time not limiting their terrestrial networks' ability to accommodate new applications and services in response to consumer demands for improvements in coverage, quality, and capacity.

It is unclear at this point whether CMRS licensees could deploy in-flight wireless services using picocell technology or by any other means without causing harmful interference to other licensees. What is clear is that a solution can only be reached by the cooperative efforts of the CMRS industry, and implementation of any solution will require careful coordination among, and consent of, all CMRS licensees whose terrestrial service could be affected. Accordingly, the Commission should amend its rules to give CMRS licensees the flexibility to provide such services. It is essential, however, that the Commission not take action that would result in increased risk of interference to CMRS licensees, and any rule changes must ensure that licensees' rights are protected and must not favor one technology over another.

Cingular and Verizon, accordingly, urge the Commission to take the following steps:

- Confirm that CMRS licensees are authorized to operate picocells aboard aircraft within their licensed service areas and frequency blocks, subject to coordination with, and the consent of, all co-channel licensees that would be affected by such operations.
- Permit the airborne use of CMRS mobiles to communicate only through such picocells.
- Adopt only the minimum rule changes that are necessary to codify these policies, such as (a) rules applicable to all broadband CMRS services that would allow wireless devices to be used while airborne only when they are communicating through picocells installed in the aircraft and operated pursuant to the CMRS license of the licensee for the relevant area and frequency block, (b) rules establishing the inter-licensee coordination distance for this form of service and

requiring the consent of affected licensees, (c) rules treating airborne picocells as the equivalent of base stations, and (d) rules establishing how E911 service should be provided for airborne picocell-based callers.

## DISCUSSION

### I. THE COMMISSION SHOULD CONFIRM THAT CMRS LICENSEES HAVE THE FLEXIBILITY TO PROVIDE SERVICE TO CUSTOMERS ABOARD AIRCRAFT IN FLIGHT USING ON-BOARD PICOCELLS, PROVIDED THAT THEY COORDINATE WITH, AND OBTAIN CONSENT FROM, POTENTIALLY AFFECTED LICENSEES

#### A. CMRS Licensees Have the Exclusive Authority to Provide CMRS, Including Airborne Service, on Their Licensed Spectrum Within Their Service Areas

The Commission has acknowledged that cellular and PCS licensees have exclusive licenses for the use of their assigned spectrum for CMRS within their respective license areas, free from harmful interference.[4] In the *UWB Reconsideration Order* the Commission agreed that "cellular and PCS licenses are exclusive in the sense that *no other carriers will be allowed to provide cellular or PCS service in the same frequency band, in the same area, and at the same time.*"[5] As a result, radio facilities may only be used to provide CMRS by the holder of the license for the particular frequency band and geographic area being served. This is true not only for service provided by high-powered traditional base stations but also picocells and other low-

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[4] *See Ultra-Wideband Transmission Systems*, ET Docket No. 98-153, *First Report and Order*, 17 FCC Rcd 7435, ¶ 271 (2002); *AirCell, Inc.*, 15 F.C.C.R. 9622, ¶ 29 n.94 (2000) (*AirCell Order*) (acknowledging that under 47 C.F.R. § 22.905(a), a "channel block is assigned exclusively to one licensee for use in that licensee's cellular geographic service area"), *aff'd in part and remanded in part sub nom. AT&T Wireless Services, Inc. v. FCC*, 270 F.3d 959 (D.C. Cir. 2001), *after remand, AirCell, Inc.*, 18 F.C.C.R. 1926 (2003) (*AirCell Remand Order*), *aff'd sub nom. AT&T Wireless Services, Inc. v. FCC*, 365 F.3d 1095 (2004); *see also AT&T Wireless Services, Inc. v. FCC*, 270 F.3d 959, 963-64 (D.C. Cir. 2001).

[5] *Ultra-Wideband Transmission Systems*, ET Docket No. 98-153, *Memorandum Opinion and Order and Further Notice of Proposed Rule Making*, 18 F.C.C.R. 3857, ¶ 74 (2003) (*UWB Reconsideration Order*).

powered facilities used to provide service.[6] The Commission has also expressly held that service provided by means of picocells constitutes CMRS.[7]

Finally, a CMRS licensee's license includes the exclusive right to provide service from transmitters on its frequencies even when those transmitters are in the airspace above the licensee's authorized geographic service area. For example, the use of airborne transmitters at up to 100,000 feet elevation has been held to be within the scope of a narrowband PCS licensee's authorization.[8] There are no elevation limits on the geographic scope of a cellular or PCS license. Even the cellular airborne rule, 47 C.F.R. § 22.925, is not a limit on the scope of a cellular licensee's authorization; it merely regulates the use of mobile devices by customers in the interest of interference protection. As a result, the Commission found in *AirCell* that a waiver of this restriction was warranted when there were other means of addressing interference and did not require any further authorization; moreover, it found that the provision of service from a cellular base station to airborne customers was "airborne cellular service" provided by the base station licensee and resold by the vendor of the service.[9] The Commission also held that the cellular rules other than § 22.925 did *not* limit a cellular licensee's ability to serve an airborne

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6 *See, e.g., FCI 900, Inc.*, 16 F.C.C.R. 11072, ¶ 13 (2001) (extending construction deadline to permit the use of picocells to satisfy construction requirement); *Personal Communications Services*, GEN Docket 90-314, *Third Report and Order*, 9 F.C.C.R. 1337, ¶¶ 159, 196, 238, 253, 262 (1994) (discussing deployment of picocells in PCS networks); *Cellular Unserved Areas*, CC Docket 90-6, *First Report and Order*, 6 F.C.C.R. 6185, ¶ 25 (1991) (holding that area covered by low-powered cell enhancer constitutes part of licensee's service area)

7 *Regulatory Treatment of Mobile Services*, GN Docket 93-252, *Second Report and Order*, 9 F.C.C.R. 1411, ¶ 70 (1994).

8 *Petition for a Declaratory Ruling, a Clarification or, in the Alternative, a Waiver of Certain Narrowband Personal Communications Services (PCS) Rules as they Apply to a High-Altitude Balloon-Based Communications System*, 16 F.C.C.R. 16421, ¶¶ 2, 15 (WTB 2001) (*Balloon-Based Communications System*) (balloon-mounted transmitters operating at up to 100,000 feet within licensed territory are covered by license for narrowband PCS).

9 *AirCell Order* at ¶ 13.

customer from its licensed facilities, thereby confirming that a CMRS licensee's authorization is not limited to terrestrial service.[10]

Accordingly, the provision of wireless phone service to the mobile devices of passengers in an aircraft, using a picocell operating on CMRS frequencies, constitutes CMRS and can only be provided pursuant to the license issued for the frequencies at issue in the service area where the airplane is located at the time. The holder of a CMRS license has the exclusive ability to provide service in this way in its authorized service area, either directly or through an agent or spectrum lessee.[11]

### B. The Public Interest Would Be Served by Ensuring CMRS Licensees Have the Flexibility to Offer Service Aboard Aircraft via Picocells Based on Coordination with, and the Consent of, Affected Licensees

The only way for the Commission to provide the proper incentives to make picocell-based airborne service viable while fully protecting terrestrial service is to ensure that CMRS licensees have the flexibility to provide this service within their licensed areas and frequency bands. If the airborne transmissions are not under the terrestrial co-channel licensee's control, terrestrial service will inevitably be impaired, because an independent airborne operator has no incentive to protect the integrity of terrestrial service and lacks the ability to engage in integrated

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10 *AirCell Order* at ¶ 26.

11 Similarly, the use of CMRS spectrum to link an aircraft to ground networks falls squarely within the authority of a CMRS licensee. In the *AirCell* case, the Commission granted a waiver to permit a CMRS licensee to communicate with an aircraft outside its service area, within another licensee's service area. This approach presents considerable coordination and interference issues because the transmissions from the aircraft to the ground occur outside the service area of the party held responsible. This results in obscuring the clear lines of responsibility that follow if a licensee is responsible for use of its spectrum within its own service area. As discussed in Sections I.B and I.C, linking the right to transmit on spectrum at a particular location to the CMRS license for that area would facilitate coordination, consent, and thus interference prevention.

airborne-terrestrial spectrum management. This approach also promises to incent all of the terrestrial carriers in an area to support a viable approach to airborne picocell service that will minimize the likelihood of high-powered transmissions from airborne CMRS devices.

The fact that a given flight may pass through many wireless carriers' territories, some for only a short time, does not diminish the value of relying on licensees to come up with a solution to the issue of airborne picocell service. It is a trivial matter to determine the terrestrial carrier in each frequency band on a real-time basis as a flight progresses, and to conform the picocell system's operation to the requirements of the licensees being overflown. The same technology that permits a consumer GPS handheld unit to pinpoint one's position on the interstate highway system anywhere within the United States will allow a picocell to determine with precision the agreed-upon parameters for spectrum usage at any given location simply by comparing the coordinates of the plane's location to a database of service area boundaries, frequencies, and operating conditions. The CMRS carriers being overflown will be able to control the picocell's spectrum usage by participating in ownership of the operating company through a consortium, by contract giving the operating company authority to act as its agent, or by assigning it spectrum rights as a lessee through secondary market transactions.

If the Commission reaffirms CMRS licensees' rights in this regard and removes any regulatory obstacles to their development of airborne service within their territories, CMRS licensees will have every reason to work together to develop any necessary standards and to operate their airborne service through consortia, agents, or lessees that would rapidly assemble the operating rights covering most or all of the nation.[12] If airborne picocell service can be

[12] Initially, some carriers may not participate or may withhold their consent. The fact that there may be "holdouts" is no reason to override the rights of terrestrial licensees choosing not to

(continued on next page)

profitably provided without unacceptable interference to terrestrial service, all licensed carriers will have incentives to participate. It will be in a carrier's interest to join a consortium, lease its spectrum rights to an airborne network manager, or appoint an airborne operator as its agent for operating picocells on its spectrum while over the carrier's territory. It will also be in a carrier's interest to consent to reasonable spectrum management arrangements that will facilitate airborne service that will ultimately benefit the carrier's own customers, and avoid adverse effects on its network's capabilities. Likewise, it will be in the airborne operators' interest to acquire the rights to use multiple frequency blocks for airborne service and provide service accessible via multiple technologies in as many places as possible in order to provide seamless service to all passengers on the planes they serve.

The complex arrangements needed to provide seamless service, without the need to switch between frequency blocks as different carriers' service areas are overflown, can only be developed through unfettered private negotiations — and such market-oriented results can only be reached if licensees' exclusive rights are not compromised by the Commission.

For these reasons, the public interest would be served by assuring that any operation of an airborne picocell, and of a wireless device under the control of such picocell, must be under the control of the licensee of the spectrum block(s) used in the area of operation, or that licensee's agent or lessee, provided that the licensee has coordinated with, and obtained consent from, all the co-channel licensees within line of sight of the aircraft's flight path. The public interest would therefore be served by confirming that cellular and PCS licensees have the flexibility to

(footnote continued)
participate. If the service turns out to be viable and can be offered without having an adverse effect on terrestrial service through licensees' working closely with each other, the initial holdout licensees will eventually be incented to participate. Forcing them to participate before market forces have motivated them to do so will cause more problems than it will solve.

provide service to airborne customers either directly or through secondary market transactions or consortia with other licensees.

In sum, the Commission should reaffirm and codify that the holder of a cellular or PCS license is the only party who can permit airborne operations on its frequency block within its territory. That licensee will have an incentive to ensure coexistence between the airborne and terrestrial use of its spectrum. Market forces will incent the licensee to protect terrestrial service as well as to facilitate the additional revenue stream that would result from efficient airborne service and provide a wider variety of services to its customer base. Licensees have the right and obligation to control the use of picocells and wireless devices on their frequency block in their service area in order to both (a) manage the efficient usage of spectrum to provide reliable service and (b) prevent harmful interference to their own and adjacent licensees' networks.

### C. CMRS Licensees Are the Parties Best Positioned to Address the Challenges of In-Flight Picocell Service

There are many challenges to developing an in-flight CMRS picocell service, as the *Airborne NPRM* acknowledges. These challenges can best be addressed if the CMRS licensees in whose territory the service will be operating have an incentive to make the service work. Moreover, by giving this incentive to the parties who would suffer the greatest harm if the service is not implemented properly, the Commission can rely on market forces to develop the solution through industry cooperation and standards development, instead of adopting prescriptive regulations that may skew the incentives. If the incentives are not properly established, the Commission may retard development and create an unnecessary risk of interference that adversely affects terrestrial CMRS services that are relied upon by consumers, business users, and public safety officials.

The most daunting challenge is interference. The Commission has long recognized that airborne cellular transmissions pose significant issues of interference to terrestrial networks.[13] Until now, the only serious issue has related to interference caused by airborne transmissions on mobile channels, which can potentially be received by multiple cellsites on the ground and affect service to terrestrial customers. The FCC adopted 47 C.F.R. § 22.925, its rule banning airborne mobile usage, because of such concerns.[14]

The use of airborne picocells within aircraft to act as base stations in the air serving passengers' devices increases the complexity of the interference challenge. These airborne picocells also have the potential to be received by, and interfere with use of, terrestrial customers' devices on the ground. Moreover, passengers' devices will attempt to communicate with terrestrial sites at high power unless a means is found to ensure they communicate only through the picocell. Today's typical CMRS wireless devices will attempt to communicate through their home carrier's terrestrial sites or those of a roaming partner and will scan both cellular bands and all of the standard broadband PCS frequencies (1850-1910/1930-1990 MHz) to find the highest-ranked system available. Thus, if a favored terrestrial network's signal is received, even weakly, the device will attempt to communicate with that network at high power rather than with the picocell at low power. And because an airborne device may encounter signals from multiple ground networks in each frequency block, it may end up attempting to communicate with a distant cellsite at maximum power, potentially interfering with other sites close to the flight path. Accordingly, the presence of a picocell does not guarantee that a

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13 *Airborne Use of Cellular Units,* CC Docket 88-411, *Report and Order,* 7 F.C.C.R. 23 (1991).

14 *Id.*; *see also* FCC Public Notice, Report No. CL-142, mimeo 0200 (Oct. 11, 1984).

wireless device will act in a controlled, low-power manner; it may attempt to communicate with ground sites at high power.

As a result, some scenarios for airborne picocell operation would require the deployment of "jammers," "blocking devices," or "noise floor elevators" — transmitters operating on other CMRS base station frequencies — alongside (or incorporated into) the airborne picocells in order to mask terrestrial base station signals and prevent devices from attempting to communicate through them at high power. Such jammers are not legal, however.[15] Alternatively, the picocell itself might offer service on each frequency band using each digital technology.[16] To be effective at blocking mobile devices from communicating with the ground, the picocell or jammer would need to transmit a signal stronger than that received from the ground (stronger by 10 dB or more, in the case of CDMA). At the power level necessary to accomplish this, the picocell or jammer presents a significant risk of interfering with terrestrial devices' reception.

All of these transmitting devices would be operating in the airspace in the geographic service area of CMRS licensees providing service to terrestrial customers on the same

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[15] The use of jammers is prohibited by 47 U.S.C. § 333, which provides that "[n]o person shall willfully or maliciously interfere with or cause interference to any radio communications of any station licensed or authorized by or under this Act . . . ." *See also* 47 U.S.C. §§301, 302a, 47 C.F.R. §§2.803, 2.1203, 22.377; FCC Website, *Operations: Blocking and Jamming*, <http://wireless.fcc.gov/services/cellular/operations/blockingjamming.html>. In *AirCell, Inc.*, 17 F.C.C.R. 19586 (WTB 2002), the Commission held that the use of jammers to facilitate in-flight picocell service was illegal, stating, "intentional jamming or interfering with other radio signals would constitute a violation of the Communications Act." *Id.* at ¶ 4.

[16] The Commission recognized that it may be desirable for picocells to control handsets using a variety of air interfaces in order to prevent handsets from contacting terrestrial systems using their native technology, *Airborne NPRM* at ¶ 15, but this approach would also appear to require picocells that can control handsets on all spectrum bands to which the handsets have access. Many handsets are capable of using all the cellular and PCS bands, for example, and will scan all bands for a home network system or a system that is on the handset's preferred roaming list, rather than use the strongest signal.

frequencies. Under the current rules and the licenses that have been issued to CMRS licensees, only the licensee (or a lessee of its spectrum rights) may provide service through a picocell within the geographic area and spectrum to which that licensee has exclusive rights.

Another possible way to avoid strong, potentially interfering signals from emanating from airplanes is to use transparent or semi-transparent shielding material on the aircraft windows. We are unaware of any tests of this approach to date. There are several obvious disadvantages to this method, however, even if it is effective at preventing interference: shielding all of the windows in each aircraft would be costly, and shielding that is effective will also diminish the ability of passengers to use their devices when the aircraft is not in flight.

The CMRS licensees in any given area have a collective interest in preventing interference from airborne use of CMRS spectrum, because such interference will have its greatest effect on terrestrial operations within a relatively short distance from the aircraft — *i.e.*, on the co-channel licensees being overflown. Each overflown licensee has an economic incentive to prevent interference that degrades or disrupts its service on the ground. If the picocells using a given licensee's spectrum devices can only be operated under that licensee's authorization (either by the licensee itself or its agent or spectrum lessee), the overflown licensee will have an economic incentive to make in-flight usage work by, among other things, coordinating with co-channel CMRS licensees regarding airborne operations and obtaining their consent, based on a mutually acceptable spectrum management approach. CMRS licensees will, at the same time, also have an economic incentive to prevent interference that adversely affects its own terrestrial operations. By reserving the right to use a block of spectrum to the overflown licensee, that licensee may be able to integrate airborne operations with its terrestrial service and manage the interference to minimize any adverse effects on customers. The licensee also has

multiple incentives to support the provision of non-interfering airborne picocell service, because this service will both extend the range of services it offers to the public and provide an additional potential source of revenue.

An important benefit to reserving the right to provide airborne picocell service to the terrestrial licensee on the band affected is that the Commission would not need to develop detailed standards for the level of permissible interference. Instead of determining in advance what will constitute "harmful interference" or "unacceptable interference," which would inevitably be based on assumptions about terrestrial systems that may conflict with how actual networks operate (or may operate in the future), the Commission would simply leave it to the licensee to determine how to balance airborne and terrestrial spectrum usage in its territory — and to reach agreement with neighboring co-channel licensees on achieving a similar balance in their territories. As we discuss below in Section II.A.1, the interference issue is a difficult one for the Commission to resolve, because the establishment of permissible interference levels by regulatory mandate inevitably diminishes licensee rights and presents obstacles to technological evolution. By instead relying on licensees' incentives to avoid interfering with their own operations, the Commission would avoid the need to prescribe any standards.

One possible component of a solution may be the development of flight-friendly wireless devices that are designed to communicate only through a picocell if one is present. Such devices could be distinctively identified through use of a standardized icon or LED display, which would greatly enhance airline workers' ability to verify that a device is authorized for in-flight use, similar to the icons developed by the Consumer Electronics Association to reflect that a personal

electronic device's transmitter has been disabled.[17] Reliance on terrestrial carriers for in-flight operations would have the benefit of giving those carriers an incentive to facilitate the roll-out of appropriate standards and getting flight-friendly handsets into the distribution chain in a timely manner.

Another issue that is best addressed through terrestrial licensees is customer education. As discussed in Section IV.C, the use of wireless devices in close quarters such as an airplane cabin presents significant issues of wireless etiquette — *i.e.*, how to use one's handset when sitting in Coach without alienating all of one's surrounding passengers and the flight crew. Wireless carriers are in the best position to educate their own customers about how and when to use, and not use, their wireless devices while in flight, and they would be incented to do so if they are involved in the provision of the airborne picocell service.

## II. THE COMMISSION SHOULD NOT AUTHORIZE THE USE OF CMRS SPECTRUM FOR AIRBORNE SERVICE BY OTHER THAN THE LICENSEE OF THAT SPECTRUM IN THE LICENSEE'S SERVICE AREA

The relatively simple approach in Section I — allow licensees to determine how their spectrum is used for airborne service in their territories — requires little action by the Commission, because it allows market forces to shape the provision of airborne picocell service, and it is unlikely to result in significant appellate controversy. By contrast, any decision that would allow the provision of airborne service by parties who are not the terrestrial CMRS licensee for the spectrum and geographic area involved presents major obstacles, both in terms of developing rules and policies and in the appellate arena. Instead of relying on the marketplace to develop utility-enhancing solutions, the Commission will need to adopt forward-looking

[17] *See* Consumer Electronics Association, *Recommended Practice: Status Indicator for and Control of Transmitters in Portable Electronic Devices (PEDs)*, Version 1.0 (Oct. 2004).

regulations with a minimal record that will inherently impair licensees' rights. Further rulemaking will likely be necessary, and appeals will follow. And, most importantly, the development of viable solutions that maximize the benefits to both terrestrial and airborne consumers will be deterred, because the companies that take advantage of whatever rules are adopted will have little incentive to protect the viability of terrestrial networks that are relied on by hundreds of millions of users.

### A. Airborne CMRS Transmissions Not Under Licensee Control Pose a Significant Interference Threat to Terrestrial Service

#### 1. The Commission Would Need to Establish Meaningful Interference Standards

Traditionally, the Commission has maintained that only "harmful" interference to primary licensed services is prohibited, relying on the international definition of harmful interference, which is incorporated into Section 2.1(c) of its rules. That definition, however, is vague and ambiguous: "Interference which . . . seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with these [International Radio] Regulations."[18]

The problem is that this standard does not take into account the complex nature of modern high-capacity digital telecommunications. Interference that would cause a 30 kHz analog FM signal to be "interrupted" or "obstructed" — as in a dropped call or a blocked call attempt — can also have a serious adverse effect on a 200 kHz GSM, 1.25 MHz CDMA, or 5 MHz UMTS digital transmission. The effect on these digital transmissions is much different, however; the digital channel is designed with multiple access technology to permit many calls to occupy a given channel and is simultaneously utilized at multiple sites spaced together closely.

[18] 47 C.F.R. § 2.1(c).

Thus, the interference has effects on service at sites even where the interference itself is not received. Instead of causing an individual call to drop, an interfering signal might cause the bit or frame error rate for the digital transmission to be raised, reducing the channel's capacity, or require power to be increased to overcome the effects of the interfering signal, which in turn reduces the effective range of a cell and may preclude some calls from being initiated or cause multiple calls to be dropped. The interfering signal will also degrade the call quality for some or all customers. Moreover, an increase in mobile power that is needed to overcome an interfering signal will have effects in other cells, which will receive interference from the mobiles' higher power signals and force their mobiles to operate at higher power, even though the other cells may not even be able to detect the original interfering signal. Those other cells, as a result, will also suffer lowered capacity, reduced coverage, and impaired quality.

In other words, an interfering signal that would be considered "harmful interference" to an *analog* call because it caused a single call to be dropped or blocked may delay or deny dozens or hundreds of *digital* calls or call attempts. Nevertheless, the Commission's outdated interpretation of what constitutes harmful interference may not be satisfied because the interference did not directly "obstruct, or repeatedly interrupt" any single communication. This narrow interpretation of the harmful interference definition is not appropriate in a digital environment. An interference source that reduces a digital cellsite's capacity or coverage by even a few percent prevents calls from being initiated or carried just as surely as an interference source that causes an analog call to be dropped or blocked. The Commission should make clear that any such interference constitutes harmful interference.

The definition also deems "harmful" any interference that "seriously degrades" a radio service. In the context of an analog FM transmission, the Commission has held that interference

to an analog FM transmission is not "harmful" even if it resulted in calls that are "objectionable," "noisy," and "annoying" to the customer.[19] Such calls are clearly "degraded," but apparently the Commission did not consider them to be "seriously degraded." Nevertheless, if the interference is sufficient to cause these effects to occur to multiple calls in a digital network or reduce the network's capacity and coverage, the Commission should make clear that such interference "significantly degrades" the entire "radiocommunication service" and thus constitutes harmful interference.

Even if the Commission does not find that the regulation's definition of harmful interference would be satisfied by airborne transmissions that have noticeable effects on terrestrial networks' coverage, quality, or capacity, the inquiry does not end there. Congress has not charged the Commission with allowing all radio transmissions that do not cause harmful interference. It has, instead, instructed the Commission to adopt rules regarding radio spectrum usage that serve the public interest, convenience, and necessity.[20] In carrying out this responsibility, the Commission has not limited itself to preventing harmful interference; indeed, it has taken steps to prevent interference that is not "acceptable," whether or not it meets the definition of "harmful" interference.

In the *800 MHz Order*, for example, the Commission articulated a "new objective technical standard" for what it considered to be "unacceptable interference" in one particular context and provided protection from it without having to determine whether it constitutes "harmful interference."[21] The standards for "unacceptable interference" employed in that

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19 *AirCell Remand Order*, 18 F.C.C.R. at 1935.

20 47 U.S.C. § 303(f), (r); *see id.* § 151.

21 *Improving Public Safety Communications in the 800 MHz Band*, WT Docket 02-55, *Report and Order*, 19 F.C.C.R. 14969, ¶ 19 (2004), *reconsideration*, 19 F.C.C.R. 25120 (2004).

proceeding indicate that the Commission believed the public interest demands protection of licensees from interference that reduces the carrier-to-interference ratio below industry standards or, in the case of digital data signals, causes the frame error rate to exceed the radio vendor's specifications for reliable service.[22] It is noteworthy that the Commission also decided to separate dissimilar operations (in that case, cellular-like ESMR systems and public safety radio services) because "we can minimize unacceptable interference in the 800 MHz band by placing similar system architectures in like spectrum and isolating dissimilar architectures from one another."[23] The Commission's use there of an "unacceptable interference" standard is similar to what it has done in many other circumstances in the past, always based on an assessment of the public interest and the characteristics of the radio service that would encounter interference.[24]

Increasingly, CMRS networks are relied on by the public not only for business and personal communications but for communications related to public safety and homeland security. The Commission should not permit the integrity and quality of these networks to be

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22 *Id.*

23 *Id.* at ¶ 22.

24 *See, e.g., Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems*, ET Docket 98-206, *First Report and Order and Further Notice of Proposed Rulemaking*, 16 F.C.C.R. 4096, ¶ 3 & n.8 (2000) ("'Unacceptable' interference are [sic] occurrences exceeding a defined 'acceptable' level of interference. We also note that the term 'acceptable' interference or 'unacceptable' interference happens to be more commonly used for international satellite coordinations."); *see also Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, IB Docket No. 01-185, *Report and Order and Notice of Proposed Rulemaking* 18 F.C.C.R. 1962 (2003); 2000 *Biennial Regulatory Review — Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations* , IB Docket No. 00-248, *Fifth Report and Order in IB Docket No. 00-248, and Third Report and Order In CC Docket No. 86-496,* 35 Comm. Reg. 617 (March 15, 2005). The Commission has also used "unacceptable interference" instead of "harmful interference" in the microwave and low-power broadcast radio licensing context. *See, e.g., Newcomb Communications, Inc.*, 11 F.C.C.R. 3084 (OET 1996); Creation of Low Power Radio Service, MM Docket 99-25, *Report and Order*, 19 F.C.C.R. 597 (2000).

compromised by airborne co-channel transmissions, whether or not those transmissions amount to antiquated notions of what constitutes harmful interference. Interfering signals not under the CMRS licensee's control that will increase bit or frame error rates or require power level adaptation will reduce capacity, coverage, and data bandwidth and must always be deemed unacceptable.

### 2. Assessment of the Level of Interference

In connection with these comments, Cingular and Verizon have commissioned V-COMM, L.L.C., an experienced engineering consultant, to analyze the interference potential of airborne CMRS operations. V-COMM is uniquely positioned to analyze the effects of airborne transmissions on CMRS operations because V-COMM has conducted more than 10,000 miles of flight tests and analyses of interference from airborne signals to CMRS on behalf of Cingular and Verizon in connection with a pending application by AirCell, Inc.[25] V-COMM has prepared a detailed report, which is attached as Exhibit I.[26] V-COMM has also conducted a study, attached as Exhibit II,[27] of the leakage of cellular and PCS signals from the cabin of an aircraft that is critical to any analysis of the interference caused by picocells and the devices using them. These exhibits are incorporated herein by reference.

V-COMM shows in Exhibit II that the aircraft body provides little or no attenuation of the signal emitted by a wireless device near a window of the aircraft. In fact, in some cases there

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[25] AT&T Wireless, Cingular Wireless, and Verizon Wireless, Comments in Opposition to Petition for Extension of the Waiver, *AirCell, Inc.*, Docket No. 02-86 (filed April 10, 2003), Exhibits I and II.

[26] Exhibit I, Sean Haynberg, David Stern, Dominic Villecco, V-COMM, L.L.C., *Technical Comments for Cellular Airborne NPRM.*

[27] Exhibit II, Sean Haynberg, David Stern, Dominic Villecco, V-COMM, L.L.C., *Airplane Cabin Leakage Study.*

is a slight *gain* when such a device is used in close proximity to the window. There is moderate attenuation when a device is used from an aisle seat location, and there could also be moderate or significant attenuation of the signal from a picocell, depending on its configuration and antenna placement. Given the lack of attenuation of a signal from a window seat location, the Commission needs to pay particular attention to the potential interference to terrestrial operations due to uncontrolled high-power call attempts by passengers.

V-COMM's report on interference in Exhibit I uses data from the test flights and drive tests in the *AirCell* proceeding to show that there will be a measurable adverse effect on terrestrial service even at airborne power levels well below the Commission's proposed 0 dBm standard. V-COMM shows that the effect of airborne emissions on terrestrial operations varies depending on the technology used in the terrestrial network, but analog and digital networks alike show significant effects from even very weak levels of received airborne signals.

Because each network differs from the next, it is impossible to set a fixed standard that will in all cases protect terrestrial networks from harmful or unacceptable interference.[28] Some networks will have a low tolerance for external interference, either because they employ widely spaced rural sites and need to communicate with wireless devices at a considerable distance or because they need to communicate with devices in buildings or in other partially obstructed

[28] The Commission's use of certain fixed signal levels to assess interference effects in the *AirCell Remand Order* does not warrant the use of those or other signal levels here. That case involved only a single airborne analog cellular transmitter's interference to terrestrial analog cellular service, a far more simplistic situation than will be the case when there are multiple airborne interferers using multiple technologies in multiple frequency bands being received at many ground locations using any of several technologies in each band. In addition, the Commission's interference analysis in the *AirCell Remand Order* used an assumed minimum received signal strength taken from a textbook and service degradation levels taken from a standard chart, *see AirCell Remand Order* at ¶ 14 & n.35, ¶ 22 & n.56, ¶ 26, while V-COMM's analysis is based on actual measured received signal strength data.

locations. *Any* unmanaged interference injected into such networks will be unacceptable, because even a rise in the noise floor of one decibel or less will result in some calls being dropped or blocked, reduced quality of service, reduced capacity, and impaired coverage.[29]

Similarly, *any* interference from airborne operations beyond the control of the licensee may impair the operation of network-based E911 location service, which requires multiple cellsites to compare reception of a single wireless device's signal, in many cases at a considerable distance from the device, in order to fix its location accurately. The cellsites may have to use a signal well below the level normally employed for communications in order to determine its location. An increase in the noise floor due to airborne transmissions could prevent the device's location from being determined accurately in an emergency.

Moreover, not only occasional individual calls may be affected. A transmission from a picocell reaching the ground, for example, may be received by thousands of terrestrial devices at the same time, causing them to lose communication with their base stations.

The effect of even small amounts of airborne interference on terrestrial networks will be significant. When such interference is encountered from multiple aircraft in line of sight of a victim receiver, as will often be the case when planes are circling over a metropolitan area and passengers in each plane are placing last-minute calls, the cumulative effect of the interference will be devastating to terrestrial service.

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[29] The increase in noise level due to such interference will have a cumulative effect with other new sources of interference, such as spurious emissions from ultrawideband devices and signals on CMRS frequencies escaping from other aircraft.

### B. The Public Interest Requires Any Airborne Cellular And PCS Operations To Respect The Rights Of Licensees

The Commission's tentative proposal to authorize all cellular licensees to operate airborne picocells without regard to territorial boundaries, on a secondary basis, cannot be reconciled with licensees' exclusive rights to provide CMRS service within their defined spectral and territorial boundaries. Likewise, any proposal to authorize third parties to operate airborne picocells without the consent and participation of the CMRS licensees being overflown will violate the licensees' rights. Those rights are well established, as the Commission has repeatedly recognized.[30] The public interest would not be served by modifying those vested rights, given the significant adverse effects to terrestrial operations that could ensue; there certainly is no record on which to base such an across-the-board modification of licensees' existing rights, as required by 47 U.S.C. § 316.

If all cellular or CMRS licensees are licensed for airborne operations everywhere, whether or not on a secondary basis, then the terrestrial licensee's control and management of spectrum usage within its license area, which is essential to the efficient operation of a CMRS network, would be severely impaired. Destroying licensee exclusivity with respect to CMRS operations within specified territorial and spectral bounds would not serve the public interest.

Even though some CMRS license areas are relatively small and will be under a flight path for only a short while, relying on the licensees would establish incentives to make airborne picocell service work without unacceptable interference to terrestrial service, if there is any way for it to work. Any other approach would overlay a newcomer — or many newcomers — providing airborne service over a terrestrial network without *any* incentive to protect that

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30 *See* Section I.A, above.

network from unacceptable interference and would, as a result, interfere with the terrestrial licensee's right to use its licensed spectrum for the provision of CMRS communications on its assigned band within its licensed territory. There is no reason to diminish licensees' rights by granting others the right to use spectrum without the consent of the licensee for the area where it is to be used.

Given the variety of technologies employed in CMRS, it would be nearly impossible to ensure that such operations are not adversely affected without the victim licensee's voluntary participation. Permitting transmissions on a given frequency block without the consent of the CMRS licensees that will be affected by receiving these transmissions necessarily diminishes the ability of those licensees to provide reliable service to their customers, conflicts with their rights as licensees, and is contrary to the public interest. This is the case even when the airborne operations do not directly cause calls in progress to be dropped.

In today's environment, GSM, CDMA, and UMTS systems carry multiple communications within a single wideband RF channel, and the effect of an interfering transmission is both subtler and more devastating than is the case with an analog transmission. *Any* interference that results in impairment of a CMRS network's ability to carry communications by increasing bit or frame error rates, or increasing power requirements, diminishes the capacity, coverage, and quality of service for many customers. Calls that would have been accommodated may not be carried, data communications may be delayed due to bandwidth reductions, and service that would have been available may become unavailable in some locations due to such interference effects. The Commission cannot, consistent with the public interest, adopt rules that will foreseeably result in interference that will degrade quality, capacity, and coverage of a public communications service on which businesses, consumers,

governmental entities, and public safety officials rely. This is true whether such interference is considered "harmful" or "unacceptable." The label affixed to the interference is not important. What is important is that the public interest would not be served by degrading the performance of terrestrial CMRS networks in order to accommodate third-party airborne operations. There is no justification for airborne use of CMRS spectrum without the voluntary consent and participation of each affected CMRS licensee.

## III. ANY RULES ADOPTED SHOULD BE TECHNOLOGY-NEUTRAL

The Commission has long recognized that for CMRS the public interest is best served by following a policy of technology neutrality, relying on market forces in this competitive sector and leaving technology standards developments to industry groups in order to further innovation and improve efficiency. Here, the Commission should follow this wise policy and not prescribe specific power levels and transmission standards that may advantage or disadvantage particular technologies. In fact, if the Commission simply leaves the operation of airborne picocells to CMRS licensees, consistent with those licensees' existing authorizations, it need not adopt any such technical rules, because licensees will have incentives to develop standards through industry groups or private agreements.

In any event, if the Commission does adopt technical rules, those rules should be neutral as to technology. For example, if the Commission adopts rules regarding wireless device usage aboard aircraft with picocells, it should not prescribe power levels that are appropriate for one technology and incompatible with another technology. The market will determine what technologies are best suited for any given application. Moreover, any power limits adopted should be crafted to avoid favoring one technology over another. Accordingly, if the Commission specifies power limits it should also specify the relevant measurement bandwidth

for any applicable power limit, and how this power limit applies to the simultaneous transmission in multiple channels.

## IV. PUBLIC INTEREST AND POLICY CONSIDERATIONS

### A. Public Safety and Homeland Security

In the event airborne use of CMRS devices through picocells is authorized, the public interest would be served by placing such operations under the authority of the local co-channel CMRS licensee for public safety and homeland security reasons. Cellular and PCS operators have worked with homeland security officials to develop wireless priority access systems that give designated officials preferential access to wireless networks in times of emergency. Any such priority access arrangements can be readily extended to service provided through picocells on aircraft, in order to allow air marshals to control communications in appropriate circumstances, such as preventing communications to or from hijackers or terrorists or ensuring that official communications have first priority in emergency situations. It would be difficult to provide such arrangements without a single local licensee per frequency block having control of airborne transmissions.

### B. E911 Issues

Before airborne service is authorized, the Commission needs to address the extent to which airborne service will be subject to the existing CMRS E911 requirements, and whether changes to those requirements are appropriate with respect to airborne operations. For example, it may not be appropriate to route E911 calls to the PSAP that has jurisdiction over the land area over which a plane is flying at hundreds of miles per hour. That PSAP will not even have jurisdiction for more than a few minutes of flight time. Obviously, that PSAP will not have the ability to reach an airborne caller with an emergency vehicle even if it has the exact coordinates

and elevation of the plane. Another E911 issue is how the handset-based or network-based location requirements should apply, given that the handsets will be in the interior of an aircraft and not in a good position to be located either through assisted GPS or cellsite triangulation. For example, the Commission may wish to consider routing all airborne E911 calls to an FAA-designated PSAP, and have the picocell report the aircraft's location based on data from the flight instrumentation. In any event, the applicability of E911 to airborne service should be fully resolved before service is deployed.

### C. Etiquette Concerns

Many comments have been filed concerning the potential for impolite and annoying use of wireless phones in flight. Cingular and Verizon share these concerns. It is important that wireless users act considerately and responsibly when making calls. Nevertheless, wireless service can be used in appropriate ways even in confined, crowded conditions and need not be socially irresponsible. For example, many wireless customers use their service principally for text messages, access to email, or other relatively silent activities. Whether or not the Commission has jurisdiction to consider the social implications of the usage of services that it authorizes, the public interest would be served in this case by allowing the airlines and carriers to work together, with consumer input, to develop the type of services that customers will welcome while in flight, rather than attempting to legislate human relations. With appropriately developed services and customer education, the public interest will be furthered by permitting airborne wireless service via picocells, to the extent such service is feasible.

As discussed in Section I.C, the challenges of operating a picocell network in an airplane are difficult to overcome with today's generation of wireless phones, because such phones will seek to communicate with stations on the ground at high power. Moreover, distinguishing

between phones that are compatible with a picocell and those that are not is not an appropriate use of a flight attendant's time. The safe and noninterfering operation of a picocell network in an aircraft will be greatly facilitated by development of "airborne safe" technology and its incorporation into the next generation of handsets. The public interest would be served by Commission encouragement of the development of standards for such equipment and facilitation of its introduction.

## V. RECOMMENDED COURSE OF ACTION

The Commission can avoid the need for extensive proceedings on airborne wireless usage by simply confirming that terrestrial CMRS licensees are the parties who have authority to provide service on their licensed frequency blocks within their territorial boundaries, that this authority extends to airborne as well as terrestrial transmitters, and that they have the flexibility to develop and offer such service after coordination with other licensees to avoid adverse effects due to interference. This would permit the Commission to eliminate the restriction on all airborne cellular usage, while not giving carte blanche to airborne service developers who might cause widespread interference. Any airborne usage, whether a picocell or a wireless device, would need to be under the authority of the terrestrial licensee below, who has the greatest incentive and ability to ensure that airborne service is developed and provided in a manner that will not unacceptably interfere with terrestrial service. The Commission should make only the minimal rule changes needed to ensure that cellular, PCS, and SMR licensees are authorized to provide picocell-based airborne service.[31]

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[31] It may be necessary, for example, to provide a definition of an airborne picocell that treats the picocell in the same manner as an in-building picocell on the ground and authorizes its use of base station frequencies. The picocell in an aircraft performs base station functions and is designed to communicate with handsets, so it should be treated as part of the licensee's base

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The Commission should not grant authority to operate in a given frequency block and area to any party other than the terrestrial licensee. Its proposal to authorize all cellular carriers to provide airborne service everywhere is a prescription for chaos that will not allow service to develop in accordance with market forces. Similarly, licensing new providers or allowing service to be provided in an unlicensed fashion will result in uncoordinated and uncontrolled radio transmissions that will inevitably degrade terrestrial communications on which members of the public rely. Confirming that the terrestrial licensee possesses the exclusive authority to provide airborne service in its territory and frequency block has many advantages:

- Economies of scale.
- Serves the existing customer base.
- Provides the ability to support new features and services transparently, integrated with the terrestrial systems.
- Facilitates any necessary wireless device upgrades, user communications, and consumer education.
- Allows careful management of wireless devices, which will be critical if implementation of an airborne-friendly mode is necessary.
- Takes advantage of preestablished roaming capabilities, benefiting both subscribers and carriers.

Absent this relatively simple, market-oriented approach, the Commission faces a much more complex course of action.

(footnote continued)
station network despite the fact that the picocell is technically a mobile station because it is designed to be used while in motion rather than while fixed. *See Balloon-Based Communications System,* 16 F.C.C.R. 16421, ¶ 13.

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